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FOR REVIEW PURPOSES

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SPS-9

VALIDATION OF SHRP ASPHALT SPECIFICATIONS AND  
MIX DESIGN AND INNOVATIONS IN ASPHALT PAVEMENTS  
(SPS-9)

PRELIMINARY MATERIALS SAMPLING AND TESTING PLAN

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PRELIMINARY MATERIALS SAMPLING AND TESTING  
PLAN FOR THE EXPERIMENT ON  
VALIDATION OF SHRP ASPHALT SPECIFICATIONS AND  
MIX DESIGN AND INNOVATIONS IN ASPHALT PAVEMENTS (SPS-9)

The Specific Pavement Studies (SPS-9) experiment on "Validation of SHRP Asphalt Specifications and Mix Design and Innovations in Asphalt Pavements" (SPS-9) has been developed to provide for a direct comparison, in terms of measured performance and life-cycle analysis, between existing highway agencies' asphalt specifications, asphalt-aggregate mixture specifications, mixture design procedures and SHRP's performance-based specifications and mix design and analysis system, ~~stone matrix asphalt (SMA) mixtures~~ and other innovative features. Test pavements for this experiment are built either as part of a new or reconstructed asphalt roadway or a rigid or flexible pavement rehabilitated (resurfaced) with an asphalt concrete overlay. Each test site will include the state's current mixture design and the mixture designed by SHRP's Mixture Design and Analysis System and/or SMA. Thus, each test site will include two or three test sections, representing one of the following three options:

- Option 1: State mixture design and SHRP Mixture Design and Analysis System (2 test sections)
- Option 2: State mixture design and SMA mixture (2 test sections)
- Option 3: State mixture design, SHRP Mixture Design and Analysis System, and SMA mixture (3 test sections)

The experiment requires the construction of two or three test sections at each test site. In addition, two test sites may be constructed on each project. Further, test sites will be constructed in each of 51 different climatic regions. Because of the variation between test sites in layer thickness, asphalt-aggregate mixtures, and construction practices, it is important to develop and implement a sampling and testing plan that will provide the information necessary to characterize the material properties and the variations in these properties between and within the test sections to help

evaluate the causes of performance differences between the test sections. Material characterization include those parameters used in current pavement design models and mechanistic analysis models, and the engineering properties required to evaluate material behavior due to load and environment variations.

The proposed materials sampling and testing plan for these experiment were developed based on experience gained from the General Pavement Studies (GPS) and other SPS experiments. The proposed tests are considered relevant for pavement design and performance analysis or for material specifications for evaluating the performance-based asphalt-aggregate mixture specifications and mix design and analysis system developed by SHRP.

The proposed sampling and testing plan includes two types of testing activities: Pavement materials/performance testing and asphalt mixture testing, which will be referred to as Pavement Testing and Asphalt Testing, respectively. "Pavement Testing" includes tests intended for material characterization and pavement performance evaluation. "Asphalt-Testing" includes tests intended for asphalt research and validation of SHRP performance-based specifications.

For rehabilitated pavements, "Pavement Testing" includes sampling and testing of the existing pavement layers and the asphalt concrete overlay. For sites involving new or reconstructed flexible pavements, "Pavement Testing" includes sampling and testing of all pavement layers. Table 1 presents a summary of the samples and tests required for existing pavement layers of rehabilitated flexible and rigid pavements. Table 2 presents a summary of the samples and tests required for subgrade and subbase layers of a test site involving new construction or reconstruction. Table 3 presents a summary of the samples and tests required for the asphalt concrete overlay of a rehabilitated pavement or the asphalt layers of a newly constructed or reconstructed pavement. Figures 1 and 2 illustrate sample locations for the different pavement layers for newly constructed/reconstructed and rehabilitated pavements, respectively.

"Asphalt Testing" consists of bulk samples of the asphalt cement, aggregate, and uncompacted asphalt concrete mixes used in the asphalt layers and cores of

the finished asphalt surface or overlay used in the test sections. Table 4 presents a summary of the bulk samples required from each test section. Table 5 presents a summary of the asphalt concrete cores required from each test sections and the type of tests to be performed. As indicated in Table 5, cores are required at each of 10 points in time during pavement life, starting immediately after construction and continuing to 168 month (14 years) after construction. As shown in Figure 3, twenty-two cores will be taken at each time interval over a 20 feet long pavement section at each pavement end. Half of these cores will be extracted from the wheel path and the other half from between wheel paths. To accommodate this sampling, ten, 20 feet long pavement sections will be required at each end of the monitoring test section, as illustrated in Figure 4. It is desirable that these sampling sections be located adjacent to the monitoring length. However, if this is not feasible, these sampling sections should be located as close as possible to the test section. Tests to performed on these cores or entraxted binder are listed in Table 4.

The proposed "Pavement Testing" is required for each of the test sections, i.e. those constructed with conventional, SHRP, and SMA mixtures. However, the proposed "Asphalt Testing" is required only for those sections constructed with conventional and SHRP mixtures. Sampling and testing of materials and cores from SMA test sections for "Asphalt Testing" are left to the discretion of the participating highway agency.

TABLE 1

SPS-9 LABORATORY TESTING PLANS FOR REHABILITATION PROJECTS - EXISTING PAVEMENT

Material Type and Properties	SHRP Test	SHRP Protocol	Number of Tests	Samples
<b>EXISTING PORTLAND CEMENT CONCRETE</b>				
Splitting Tensile Strength	PC02 4"	P62	9	C1-C9
PCC Coefficient of Thermal Expansion	PC03 6"	P63	1	A1
Static Modulus of Elasticity	PC04 6"	P64	1	A2
Core Examination / Thickness	PC06 4 1/2 6"	P66	12	C1-C9, A1-A3
<b>EXISTING ASPHALT CONCRETE</b>				
Core Examination/Thickness	AC01 4 1/2 6"	P01	15	C1-C12, A1-A3
Field Moisture Damage	AC08 6"	P08	3	A1-A3
Resilient Modulus	AC07 4"	P07	3	C1-C12
Tensile Strength	AC07	P07	3	(FROM Mr)
<b>EXISTING UNBOUND GRANULAR BASE</b>				
Particle Size Analysis	UG01	P41	3	BA1-3/TP1-3
Sieve Analysis (washed)	UG02	P41	3	BA1-3/TP1-3
Atterberg Limits	UG04	P43	3	BA1-3/TP1-3
Moisture-Density Relations	UG05	P44	3	BA1-3/TP1-3
Resilient Modulus (at in-situ density and moisture)	UG07	P46	3	BA1-3/TP1-3
Classification	UG08	P47	3	BA1-3/TP1-3
Natural Moisture Content	UG10	P49	3	BA1-3/TP1-3
In-Place Density and Moisture (Test Pits Only)	SHRP-LTPP Method		3	TP1-3
<b>EXISTING TREATED BASE</b>				
Type and Classification of Material and Treatment	TB01 6"	P31	3	A1-A3
Pozzolanic/Cementitious: Compressive Strength	TB02 6"	P32	3	A1-A3
Asphalt Treated: Dynamic Modulus (77°F)	TB03 4"	P33	3	C1-C9
HMAC: Resilient Modulus	AC07 4"	P07	3	C1-C9
<b>SUBGRADE UNDER EXISTING PAVEMENT</b>				
Sieve Analysis	SS01	P51/51A	3	BA1-3/TP1-3
Hydrometer to 0.001mm	SS02	P42	3	BA1-3/TP1-3
Atterberg Limits	SS03	P43	3	BA1-3/TP1-3
Classification and Type of Subgrade	SS04	P52	3	BA1-3/TP1-3
Resilient Modulus (at in-situ density and moisture)	SS07	P46	3	BA1-3/TP1-3
Unit Weight (From UD samples)	SS08	P56	3	BA1-3/TP1-3
Natural Moisture Content	SS09	P49	3	BA1-3/TP1-3
In-Place Density and Moisture (Test Pits Only)	SHRP-LTPP Method		3	BA1-3/TP1-3
Depth to Rigid Layer	SHRP-LTPP Method		3	S1-3

TABLE 2

**SPS-9 LABORATORY TESTING PLANS - SUBGRADE, SUBBASE AND BASE LAYERS  
FOR NEW AND RECONSTRUCTION PROJECTS**

<b>Material Type and Properties</b>	<b>SHRP Test</b>	<b>SHRP Protocol</b>	<b>Number of Tests</b>	<b>Samples</b>
<b>UNBOUND GRANULAR BASE</b>				
Particle Size Analysis	UG01	P41	3	B4-B6
Sieve Analysis (washed)	UG02	P41	3	B4-B6
Atterberg Limits	UG04	P43	3	B4-B6
Moisture-Density Relations	UG05	P44	3	B4-B6
Resilient Modulus (at in-situ density and moisture)	UG07	P46	3	B4-B6
Classification	UG08	P47	3	B4-B6
Natural Moisture Content	UG10	P49	3	B4-B6
In-Place Density and Moisture	SHRP-LTPP Method		9	T10-T18
<b>TREATED BASE/SUBBASE</b>				
Type and Classification of Material and Treatment	TB01	P31	15	C1-C15
Pozzolanic/Cementitious: Compressive Strength	TB02	P32	6	C1-C6
Asphalt Treated (Low Quality): Dynamic Modulus (77°F)	TB03	P33	3	C1-C12
<b>ASPHALT TREATED BASE (High Quality)</b>				
Core Examination/Thickness	AC01	P01	18	C1-C21
Bulk Specific Gravity	AC02	P02	18	C1-C21
Maximum Specific Gravity	AC03	P03	1	BT-1
Asphalt Content (Extraction)	AC04	P04	1	BT-1
Moisture Susceptibility	AC05	P05	1	BT-1
Resilient Modulus	AC07	P07	3	C1-C12
Tensile Strength	AC07	P07		(FROM Mr)
<b>SUBGRADE</b>				
Sieve Analysis	SS01	P51/51A	3	B1-B3
Hydrometer to 0.001mm	SS02	P42	3	B1-B3
Atterberg Limits	SS03	P43	3	B1-B3
Classification and Type of Subgrade	SS04	P52	3	B1-B3
Resilient Modulus (at in-situ density and moisture)	SS07	P46	3	B1-B3
Unit Weight	SS08	P56	3	B1-B3
Natural Moisture Content	SS09	P49	3	B1-B3
In-place Density and Moisture	SHRP-LTPP Method		3	B1-B3

TABLE 3

**SPS-9 LABORATORY TESTING PLANS- ASPHALT MIXES FOR  
OVERLAYS AND NEW/RECONSTRUCTION**

Material Type and Properties	SHRP Test	SHRP Protocol	Number of Tests	Samples
<b>NEW ASPHALT CONCRETE</b>				
Core Examination/Thickness	AC01	P01	21	C1-C21
Bulk Specific Gravity	AC02	P02	21	C1-C21
Maximum Specific Gravity	AC03	P03	3	BV1-BV3
Asphalt Content (Extraction)	AC04	P04	3	BV1-BV3
Moisture Susceptibility	AC05	P05	3	BV1-BV3
Creep Compliance	AC06	P06	3	BV1-BV3
Resilient Modulus	AC07	P07	3	C1-C12
Tensile Strength	AC07	P07		(FROM Mr)
<b>AGGREGATES (Extracted from NEW Asphalt Concrete):</b>				
Bulk Specific Gravity:				
Coarse Aggregate	AG01	P11	3	BV1-BV3
Fine Aggregate	AG02	P12	3	BV1-BV3
Type and Classification	AG03	P13	3	BV1-BV3
Gradation of Aggregate	AG04	P14	3	BV1-BV3
NAA Test for Fine				
Aggregate Particle Shape	AG05	P14A	3	BV1-BV3
Coarse Aggregate Particle Shape	AG06	P14B	3	BV1-BV3
<b>ASPHALT CEMENT (Recovered from NEW Asphalt Concrete):</b>				
Penetration at 50°F, 77°F, 90°F	AE02	P22	3	BV1-BV3
Specific Gravity (60°F)	AE03	P23	3	BV1-BV3
Viscosity at 77°F	AE04	P24	3	BV1-BV3
Viscosity at 140°F, 275°F	AE05	P25	3	BV1-BV3

Table 4. Material sampling for SHRP Asphalt Reasearch Program

MATERIAL AND SAMPLE DESCRIPTION	NUMBER OF SAMPLES *	MATERIAL SOURCE
Asphalt Cement (5 gallon containers)	1	PLANT
Aggregate (55 gal. drums)	1	PLANT
Finished Asphaltic Concrete Mix (50 lbs)	1	PLANT
Asphalt Concrete - 4" diam. cores	440 **	Surface course/overlay

\* From each test section

\*\* Over a 14-year period



TABLE 5

**SPS-9 LABORATORY TESTING FOR SHRP TESTS  
ON STATE CONVENTIONAL MIX AND SHRP MIX**

**(BETWEEN AND WITHIN WHEEL PATH SAMPLING)  
(4-INCH OD CORES)**

PAVEMENT AGE (MONTHS)	B INDER PROPERTIES			MIX PROPERTIES			
	SHEAR RHEOMETER	BENDING BEAM	DIRECT TENSION	DENSITY OR VOIDS	SIMPLE SHEAR	DISSIPATED ENERGY	INDIRECT TENSILE CREEP
0	X	X	X	X	X	X	X
3	X	X	X	X	X	X	X
6	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X
24	X	X	X	X	X	X	X
36	-	-	-	-	-	-	-
48	X	X	X	X	X	X	X
72	-	-	-	-	-	-	-
96	X	X	X	X	X	X	X
132	-	-	-	-	-	-	-
168	X	X	X	X	X	X	X

**X ==>> SAMPLING REQUIRED**

**- ==>> NO SAMPLING**

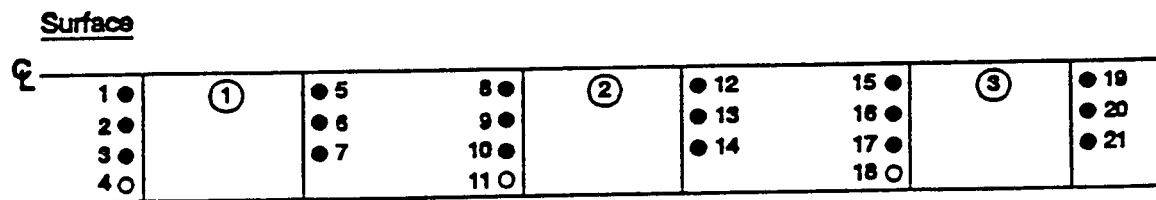
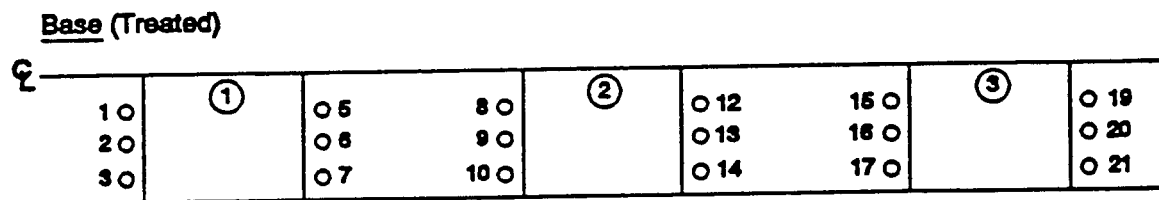
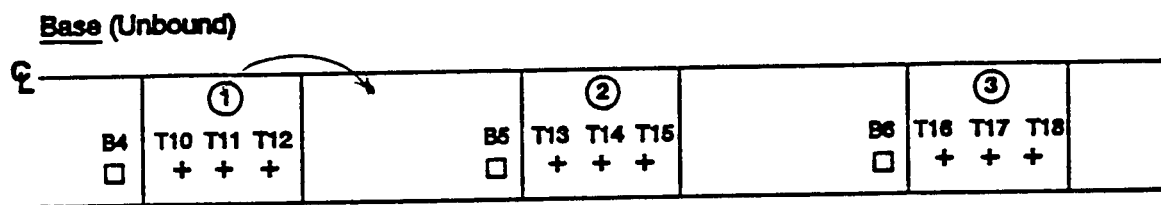
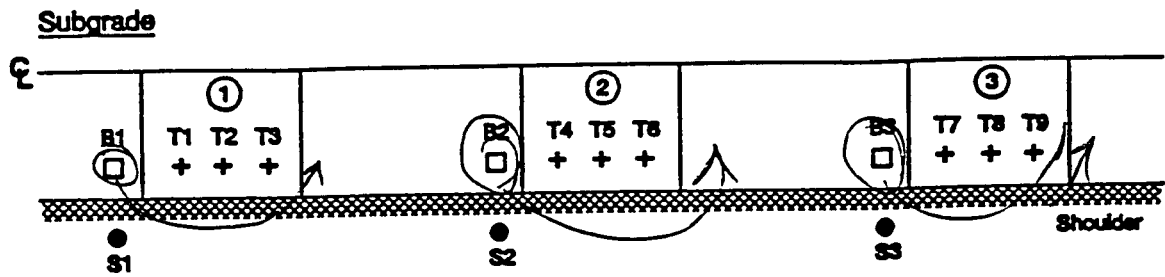
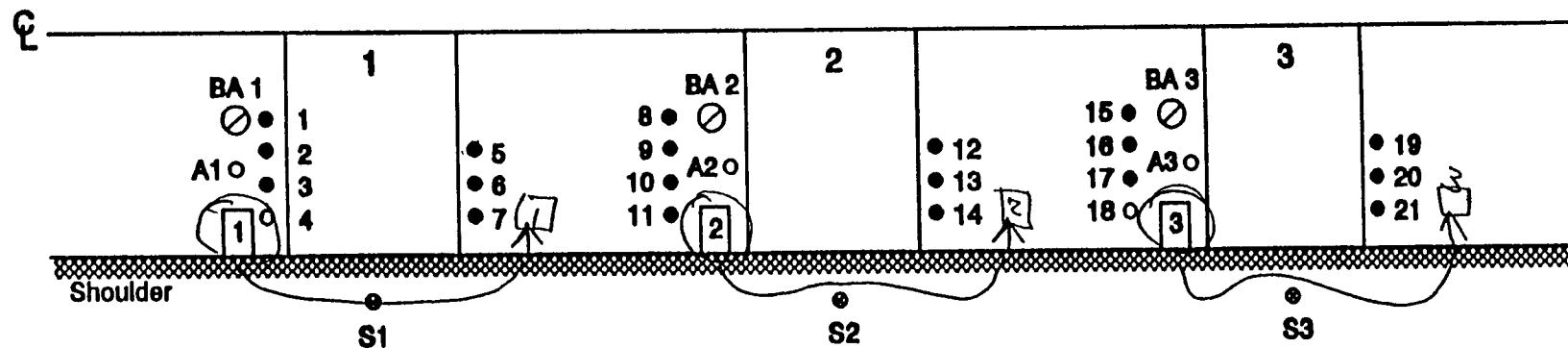


Figure 1. Sampling Layout for New Construction Projects.



**1**

**TEST PIT 4' X 6' TO 12" below top of subgrade**

**BA1**

**Bulk Auger location, 12" OD core, retrieval of underlying material to 12" below top of subgrade**

**A1**

**6" OD core, Shelby tube/splitspoon sampling to 48" top of subgrade**

**○**

**4" OD core**

**●**

**4" OD core of surface and underlying bound layers**

**• S1 Shoulder Probe.**

Figure 2. Sampling Layout for Rehabilitated Projects.

# TYPICAL PAVEMENT SAMPLING PLAN

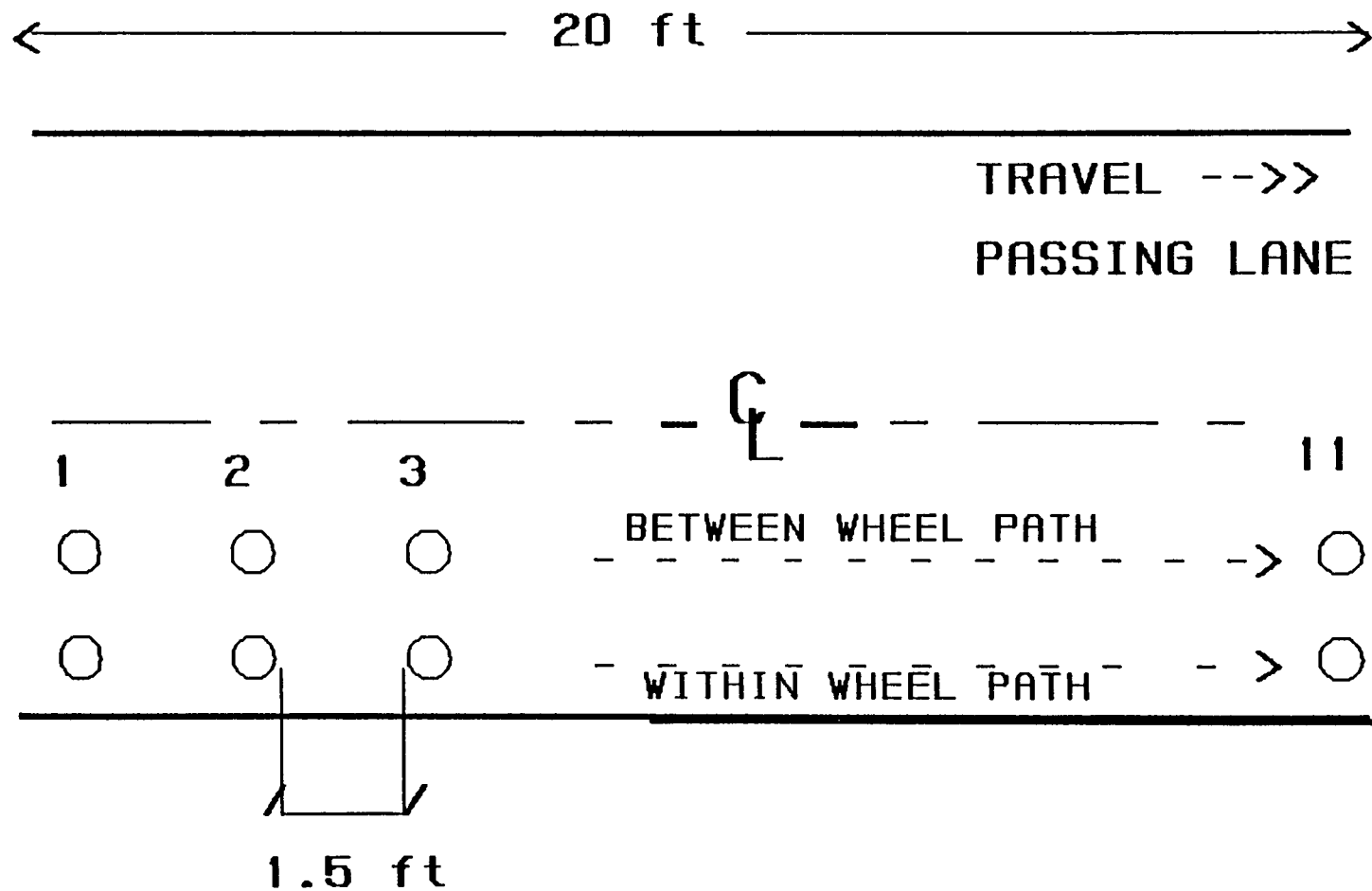
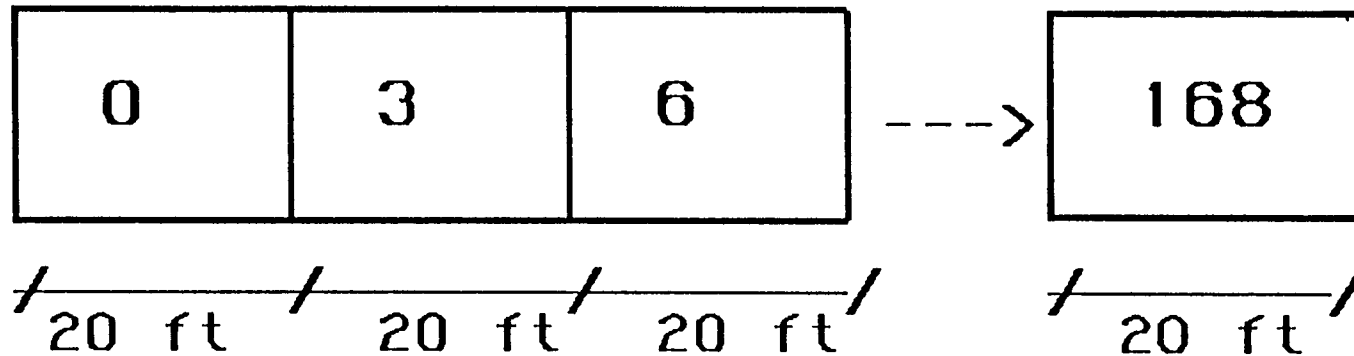


Figure 3. Locations for Asphalt Concrete Cores

# SAMPLING TIMETABLE

← TIME IN MONTHS →



← 10 SAMPLING DATES @ 20 ft →  
200 ft

Figure 4. Sampling Locations and Timetable